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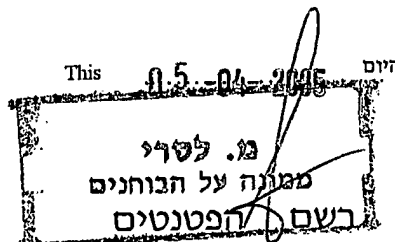
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בקשה לפטנט  
Application For Patent

אני, (שם המבקש, מענו ולגבי גוף מאוגד - מקום התאגדותו)  
I, (Name and address of applicant, and in case of body corporate-place of incorporation)

התעשייה האווירית לישראל בע"מ, חברה ישראלית מנמל התעופה הבינלאומי בן גוריון, לוד 70100, ישראל  
Israel Aircraft Industries Ltd., Israeli Company of Ben Gurion International Airport, Lod 70100, ISRAEL

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מערכת לעצירת רכבים ודוקרן עבורה

Vehicle arrestor system and spike therefor

(בעברית)  
(Hebrew)

(באנגלית)  
(English)

Hereby apply for a patent to be granted to me in respect thereof.

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• בקשת חלוקה Application of Division		• בקשת פטנט מוסף Appl. for Patent of Addition		• דרישת דין קדימה Priority Claim		
מבקשת פטנט from application		לבקשה/לפטנט to Patent/Apl.		מספר/סימן Number/Mark	תאריך Date	מדינת האיגוד Convention Country
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**מערכת לעצירת רכבים וזקרון עבורה**

**Vehicle arrestor system and spike therefor**

**Israel Aircraft Industries Ltd.**

**התעשייה האווירית לישראל בע"מ**

**C. 153061.7**

## **VEHICLE ARRESTOR SYSTEM AND SPIKE THEREFOR**

### **FIELD OF THE INVENTION**

This invention relates to equipment for arresting vehicles, particularly those interacting with the vehicle's tires.

### **BACKGROUND OF THE INVENTION**

5        There are a number of reasons for which it is desirable to arrest a vehicle without the use of lethal force typically in police and military scenarios.

To this end a variety of systems have been developed including the type of system designed to target the tires of the vehicle to be arrested. The most common of these is the type designed to deflate the vehicles tires.

10       However, a drawback to this system is that the vehicle may continue on albeit at a slower rate. Also puncturing one or more tires may cause the vehicle to lose control potentially resulting in damage to the surroundings and/or harm to the driver/passengers.

### **SUMMARY OF THE INVENTION**

15       The present invention relates to a device for arresting a vehicle passing thereover. Operation of the device can result, in some aspects of the invention, in partially or completely removing a rubber tire from a wheel of the vehicle, which, for example, may be by peeling the tire or blowing the tire off the wheel. By one embodiment where the tire is peeled, a tire penetrating member, such as a  
20       spike, has a tip that spreads upon penetrating the tire to thereby be anchored in the tire facilitating peeling thereof. By another embodiment, a volatile material enters the tire via a hollow-headed spike to blast or blow the tire from the wheel.

By other aspects of the invention, the device attaches to the tire and a component of the device, for example a rod associated therewith, inhibits rotation of the wheel via mechanical interference with the vehicle.

By yet another aspect of the invention, the device attaches to the vehicle,  
5 the device comprising a low-friction road engaging side preventing the tire from gaining traction on the road.

By still another aspect of the invention, the device is adapted to cause the vehicle tires to spin without progressing, for example, by engaging with spin-able cylinders in a manner similar to the functioning of stationary bicycles.

## 10 BRIEF DESCRIPTION OF THE DRAWINGS

In order to understand the invention and to see how it may be carried out in practice, embodiments will now be described, by way of non-limiting example only, with reference to the accompanying drawings, in which:

Figs. 1A-1B are schematic views of a vehicle arresting device in the form  
15 of "low friction stickers" according to a first aspect of the invention;

Fig. 1C is an enlargement of an area, marked II of Fig. 1B;

Fig. 1D is an illustration of the vehicle arresting device of Figs. 1A and 1B shown engaging a vehicle tire;

Fig. 2 is a side view of a schematic of the vehicle arresting device in the  
20 form of "spinning cylinders" according to another aspect of the invention;

Figs. 3A-3D are schematic views the vehicle arresting device in the form of "tire rotation interfering apparatus" according to yet another aspect of the invention;

Figs. 4A-4C are front views of a schematic of the vehicle arresting device  
25 according to yet another aspect of the invention in which the vehicle tire is at least partially removed from the associated wheel during arresting thereof;

Fig. 5 is a perspective view of a schematic of a housing for the vehicle arresting device of Figs. 4A-4C;

Fig. 6 is a perspective view of a schematic of an exemplary embodiment of the aspect of the invention shown in Figs. 4A-4C and 5, illustrating details of a tire anchoring member;

Fig. 7 is a front of a schematic illustrating one of the tire anchoring members of Fig. 6 anchored to the vehicle tire; and

Fig. 8 is a cross-sectional view of a tire attaching member for a vehicle arresting device according to the present invention.

### DETAILED DESCRIPTION OF THE INVENTION

Referring to Figs. 1A-1D, a device for arresting a land-vehicle having rubber tires, according to a first aspect of the present invention, is illustrated. The device comprises sheet-like members or stickers 10 designed to be arranged side by side on a traveling surface or road surface 12. The stickers 10 may be more or less dimensioned corresponding to the tire size of the expected vehicle to be arrested (hereinafter "vehicle"; not shown), or alternatively may be narrower than the tires whereby a number of stickers 10 engage the tires. As such the stickers 10 are typically elongated and oriented generally parallel to the road surface 12 or the expected direction of the vehicle.

The stickers 10 have a top side 14 and a bottom side 16. On the top side 14 is a road engaging member in the form of a sticky material 18 and/or a plurality of barbs 20 which stick out therefrom. The sticky material or barbs 18, 20 are designed to engage with a rubber tire 22 of the vehicle when the vehicle rolls over it. Thus, when the tires 22 (the leading, typically front tires) of the vehicle rolls upon the stickers 10, a corresponding sticker(s) wraps around those tires – as seen in Fig. 1D.

The bottom side 16 of the sticker 10 is smooth and flexible having a very low coefficient of friction. When the stickers 10 wrap around the tires 22, the bottom side 16 thereby essentially becomes the road engaging surface of the corresponding tires 22. Due to their low coefficient of friction, the bottom side 16 either spins on the road surface 12 such that the vehicle cannot progress or the

slipperiness causes loss of control whereby the driver of the vehicle is forced to stop.

Fig. 2 illustrates a device for arresting a land-vehicle having rubber tires, according to another aspect of the present invention. The device comprises a series of members upon which the vehicle tires spin, constituted according to one embodiment by rods or cylinders including a holding cylinder or large cylinder 30 at one end of the series, a pair of medium sized cylinders 32 and 34; one adjacent the large cylinder and one at an opposite end from the large cylinder, respectively. Between the two medium cylinders 32 are a plurality of small cylinders 34. The cylinders 30, 32, 34 and 36 are attached one to the next at corresponding axes 30', 32', 34' and 36' thereof such that the cylinders may spin about their axes.

The cylinders 30, 32, 34 and 36 rest on the road surface 12 and are generally held in place by a friction plate 38 which is attached to the large cylinder 30 via a member such as a triangular block 40 - the friction plate and triangular block optionally being an integral member. The cylinders can be actualized by a number of geometries, for example, one long rod, several rods, spherical members and the like.

When the vehicle's tires 22 - again, typically the front tires - pass onto the device, the vehicle is slowed by hitting the cylinders 30, 32, 34 and 36, especially the large cylinder 30, the entire device will then tend to slide in the direction in which the vehicle travels due to the vehicle's momentum, then the vehicle is arrested as its wheels interactively spin with the cylinders. This action is similar to the concept of a stationary exercise bicycle where the bicycle's wheel spins on a small wheel or cylinder attached to the frame thereof.

Figs. 3A-3D illustrate a yet another aspect of a device for arresting a land-vehicle having rubber tires according to the present invention wherein the device interferes with the operation of the tires of the vehicle to be arrested. Fig. 3A shows a top view of the device and Fig. 3B shows a side view thereof.



The device comprises a member or members, for example, a mat or strip 50, or series of side-by-side strips/mats, typically rectangular, each having a number of cables 52 running the length thereof; the cables having attached thereto a plurality of tire attaching members such as pins 54. At an end of the strips 50, the end typically arranged to be the farthest from the oncoming tires, the cables 52 are attached to a tire rotation interfering member, represented by a rod 56, running perpendicular to the cables. The rod 56 may be hollow, as illustrated in Figs. 3A and 3B which lowers its weight resulting in easier handling thereof.

10 Figs. 3C and 3D illustrate a couple of exemplary arrangements for incorporating the cables 52 into the strips 50 or attaching them thereto. In Fig. 3C the cables 52 are formed into a strip being a rubber strip 57; and in Fig. 3D the cables are attached to the strip by one or more fabric layers 58 - and the layers may constitute the strip.

15 When the vehicle tires 22 rolls onto the strip(s) 50 the pins 54 stick into the rubber tire causing the strip(s) to wrap around the tires. It is understood that the strip(s) 50 and cables 52 are appropriately flexible for this purpose. The arrangement is such that the strips 50 are well wrapped around the tires 22 by the time the rod 56 is drawn up into the associated wheel well of the vehicle at which point the rod interferes with the body of the vehicle inhibiting rotation of the wheel(s) causing the vehicle to stop.

Figs. 4A-4C are front views of a schematic of the vehicle arresting device according to yet another aspect of the invention in which the vehicle tire 22 is at least partially removed from the associated wheel during arresting thereof.

25 In Fig 4A the device is shown in its closed position and comprises a base 60 and a corresponding top 62 each having a rows of blades 64 protruding therefrom. The blades 62 may be integral or conveniently attached to the base 60 and top 62, for example by being screwed thereto which would facilitate easy replacement should the need arise. It is noticed that the blades 62 are  
30 dimensioned not to interfere with each other when the device is in a folded

position as seen in Fig. 4A. Alternatively, the blades 62 may be positioned in an off-set manner to avoid interference.

Fig 4B illustrates the device in a partially opened position; the opening aided by a pivot mechanism 66. In Fig 4C the device is seen in its fully open position, with both the base 60 and top 62 resting on the road surface 12.

Prior to when a vehicle to be arrested approaches, the device can be deployed on the road surface 12. When the vehicle tires 22 roll on the device, the blades 64 pierce the tires and grab on thereto such that when the vehicle advances, the tires are at least partially removed/peeled from the associated tire wheels and the vehicle is arrested. An example of a blade of tire engaging member facilitating this activity is detailed below in reference to Fig. 6.

If the device is deployed and one wishes to allow vehicles to pass without arresting them, a covering may be placed thereon. A covering in the form of a housing may be used. An example of such a housing is shown in Fig. 5; the housing 70 comprising inclined surfaces 72 and top surfaces 74 for allowing vehicles to conveniently pass thereover. When a vehicle to be arrested approaches, the surfaces 72 and 74 may be removed, facilitated by handles 76, thereby exposing the blades 64.

Fig. 6 is a perspective view of a schematic of an embodiment of the aspect of the invention illustrated in Figs. 4A-4C and 5 including an exemplary tire engaging member or blade. Here, the device is shown exposed in the housing 70 and comprises tire anchoring members 80 having tire piercing members 82 at their ends. Each anchoring member 80 is attached at its opposite end to a cable 84 which in turn is attached to a hook 86. Running perpendicular to the hooks 86 is a rod 88 such as rod 56 (Fig. 3B).

The blades 82 are seen in a closed position in Fig. 6, and for example, have a conical profile for facilitating piercing of the tires 22. Upon piercing of the rubber vehicle tire 22, the blade 82 opens, as seen in Fig. 7, to provide for anchoring at the tire.

The blades 82 may be opened by a variety of mechanisms. For example, they may be biased toward the open position, however held closed by a catch (not shown). The catch may be released by the action of the tire 22 coming down around the catch at its pierce point.

- 5       The blades 82 are angled toward the vehicle tire 22 at an appropriate angle and may be fixed at this angle by any of a number of known means (e.g. by constructing the bottoms of the tire anchoring members 80 to be so angled).

When a vehicle passes over the device, the blade 82 pierces the tire 22 and gets anchored therein. With the advance of the vehicle, the cable 84 gets drawn  
10 around the tire 22 and eventually the rod 88 in the hook 86 catches on the vehicle causing the anchored blade 82 to at least partially remove the tire 22 thereby arresting the vehicle.

Fig. 8 shows a cross-section of a tire attaching member 90 designed to remove at least part of the vehicle tire 22 from its wheel. This member 90 can be  
15 designed to be remotely deployed, by say a remote control (not shown) or manually/mechanically deployed.

The tire attaching member 90 includes a hollow cartridge 92 comprising a hollow spike 94 at its top designed to penetrate the vehicle tire 22. The cartridge 92 fits into a cartridge housing 96 comprising an upper housing 98 and a lower  
20 housing 100, which have corresponding screw threads 102 and 104, respectively, to allow them to be screwed to each other. The lower housing 100 is typically attached to a base 106 which could be a part of a road surface engaging structure (not shown in Fig. 8) such as a known structure already in use. The tire attaching member 90 may be angled to ensure the best tire penetration as a result of its  
25 attachment to the base 106 or by other means, such as the geometry of the lower housing 100.

The cartridge 92 also comprises a volatile/explosive or pyrotechnic material 108 at a bottom portion of the cartridge which, for example, can be activated in a manner analogous to that of a vehicle air-bag during a collision.  
30 For this purpose, the device includes a firing pin 110 adjacent the pyrotechnic

material 108. For the sake of safety, the device preferably comprises a safety catch 112 to prevent unwanted prior activation of the pyrotechnic material 108 of the device. This catch 112 is removed at the time of deployment.

5 The cartridge 92 is situated and held between an upper spring 114 and a lower spring 116. The lower spring 116 allows the cartridge to be pushed down to a level whereby the firing pin 110 actuates the pyrotechnic material 108 at a predetermined pressure appropriate to that produced by a vehicle passing thereon.

10 Alternatively, the pyrotechnic material 108 can be actuated by a remote control.

When a vehicle to be arrested rides onto the tire attaching member 90, the sharp hollow spike 94 penetrates the vehicle tire 22 and pressure on the cartridge 92 causes the firing pin 110 activate the pyrotechnic material 104. The material 104 escapes out through the top of the spike 94 and enters the tire 22 which  
15 causes the tire to be blasted from its wheel, thus arresting the vehicle.

To assemble a new tire attaching member 90, a new cartridge may simply be screwed into the place of the expended cartridge.

It will be appreciated by persons skilled in the art that the present invention is not limited by what has been particularly shown by the exemplary embodiments  
20 described hereinabove. Thus, the fastener assembly and fastening arrangement therefor can be embodied by a variety of aspects within the scope of the invention, *mutatis mutandis*.

**CLAIMS:**

1. A device for arresting the progress of a vehicle having wheels with rubber tires, the device deployable on a road surface, comprising: (a) one or more tire attaching members, (b) a treading portion, to which the tire attaching member(s) are thereto fixed, or within which the tire attaching member(s) are located, whereby upon passage thereover by the vehicle, the tire attaching member(s) attach to at least one of the vehicle tires and the treading portion interferes with the drivability of the vehicle or interaction or the tire attaching member(s) affects the integrity of at least one of the tires.
2. The device according to claim 1 wherein sticky flexible pads constitute the tire attaching members.
3. The device according to claim 1 wherein flexible pads with hooks attached thereto constitute the tire attaching members.
4. The device according to claim 3 wherein the flexible pads have a smooth and flexible steel net bottom surface being a slippery surface such that when the pads are attached to the tires there is reduced control of the vehicle whereby the driver is forced to stop said vehicle.
5. The device according to claim 1 wherein pins constitute the tire attaching members, the pins being attached to a mat constituting the treading portion, having therein longitudinal cables connected to a rod normal to the cables, the rod interfering with the vehicle to thereby arrest it..
6. The device according to claim 1 wherein one or more tire attaching member is attached to the treading portion by fabric layers.
7. The device according to claim 1 wherein one or more tire attaching member is embedded in the treading portion, the treading portion constituted by a rubber mat.
8. The device according to claim 1 wherein the device further comprises a cover constituted by a housing.

9. The device according to claim 1 wherein the tire attaching member(s) comprise spreadable blades to penetrate the vehicle tire and become anchored therein.
10. The device according to claim 9 wherein the tire attaching members are  
5 attached to a cable and hook in turn associated with a rod normal to the cable, the rod interfering with the vehicle whereby upon turning of the vehicle tires the tire is pulled back from at least one of the vehicle wheels.
11. The device according to claim 1 wherein the tire attaching members comprise a cartridge containing a volatile, reactive or explosive material.
- 10 12. The device according to claim 11 wherein the volatile material is activated as a result of pressure applied thereto by a vehicle tire or upon activation by a user.
13. The device according to claim 1 wherein the device is designed to allow it to be folded or rolled for storage and/or transport.
- 15 14. The device according to claim 1 wherein the treading portion comprises two rigid members pivotally articulated whereby the rigid members can be folded one on top of the other forming a structure whereby the blades are within said structure, for storage or allowing a vehicle to pass thereover without significant impedance.
- 20 15. A tire attaching member for a device for impeding the progress of a vehicle having rubber tires, the member comprising a housing having associated therewith a cartridge with a spike-like form, the cartridge having volatile/reactive/pyrotechnic material therein.
16. The tire attaching member according to claim 15 wherein the material is  
25 activatable by pressure from the passage/contact of at least one of the vehicle's tires.
17. The tire attaching member according to claim 15 wherein the material is activatable remotely.

18. The tire attaching member according to claim 15 wherein the spike-like cartridge is hollow to thereby allow the pyrotechnic material to flow therethrough.

19. A device for arresting the progress of an incoming vehicle having  
5 wheels with tires, the device deployable on a road surface, comprising a plurality of low friction spinable members attached one to the next, one of the spinable members being at a far end to the incoming vehicle and being of a larger dimension than the other spinable members, the spinable members engaging at  
10 least one of the vehicle tires to spin therewith and preventing tire contact with the road surface, thereby arresting the vehicle.

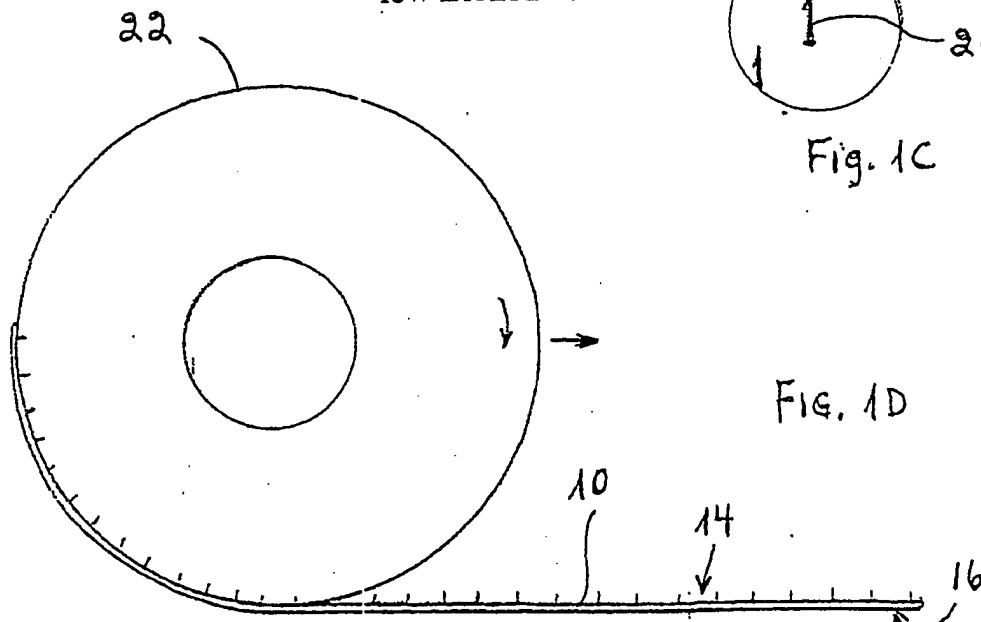
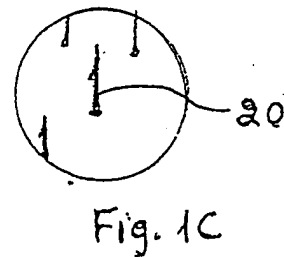
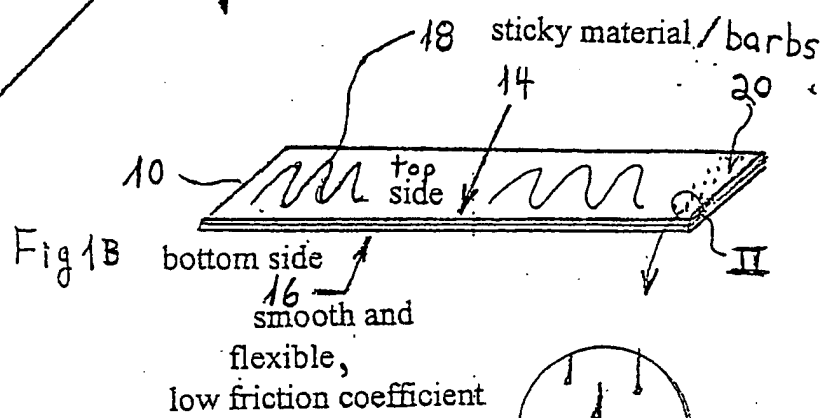
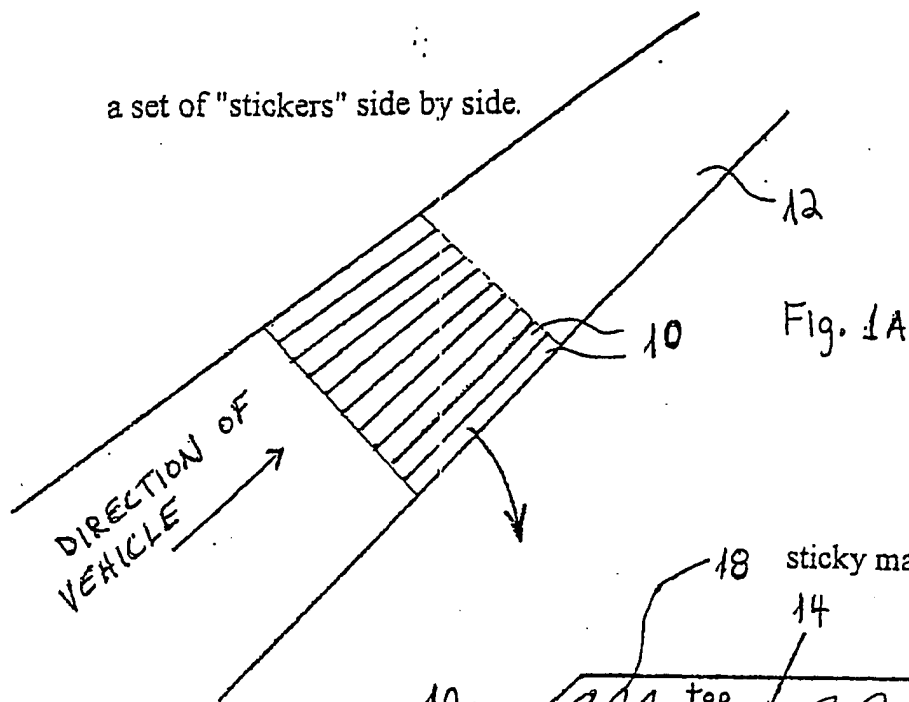
20. The device according to claim 18 wherein one or more cylinders constitute the spinable members

21. The device according to claim 18 wherein the larger dimensioned spinable member is held in place by a friction plate placed on the road surface  
15 and is designed to absorb part of the momentum of the incoming vehicle.

For the Applicants  
**REINHOLD COHN AND PARTNERS**  
By:

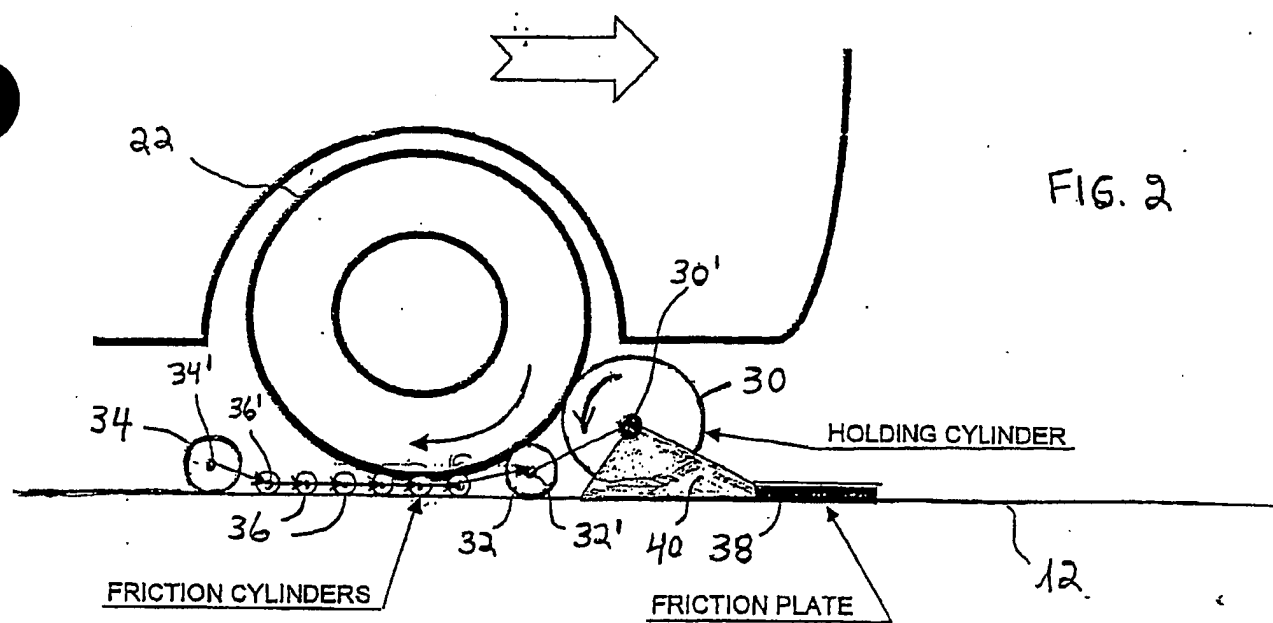
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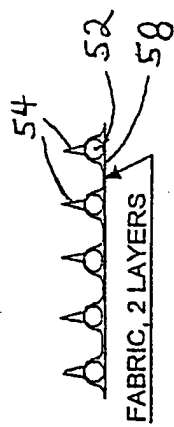
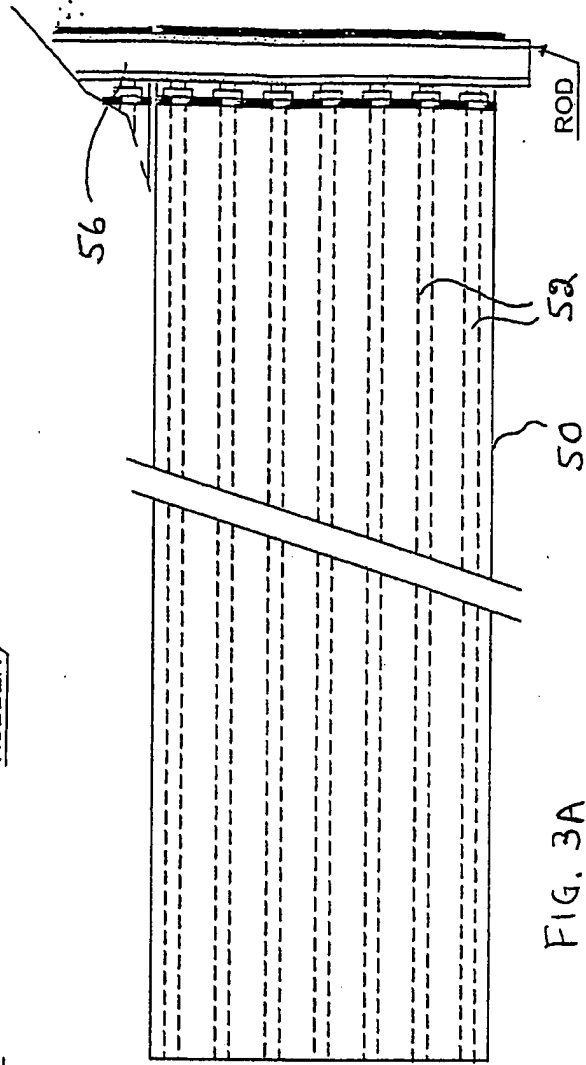
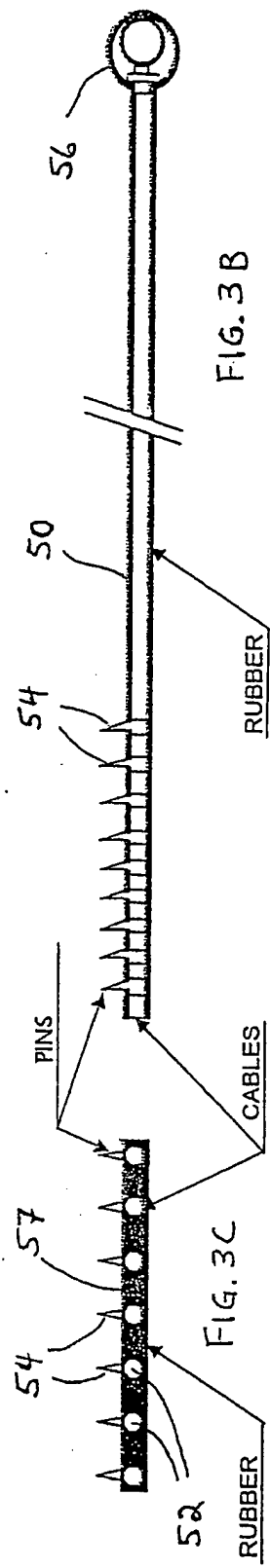
a set of "stickers" side by side.



The front wheels of the vehicle will press on the stickers, which will start to wrap around the tires







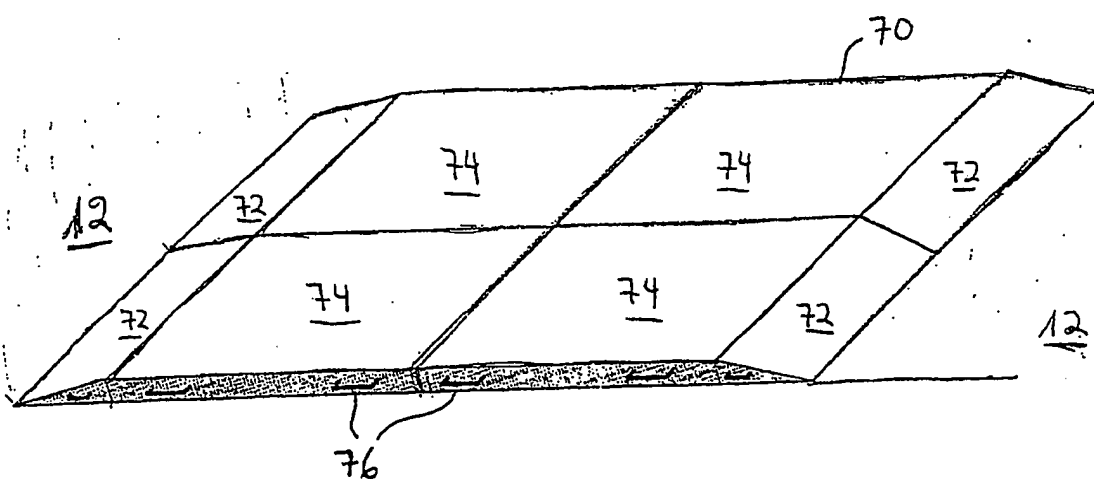
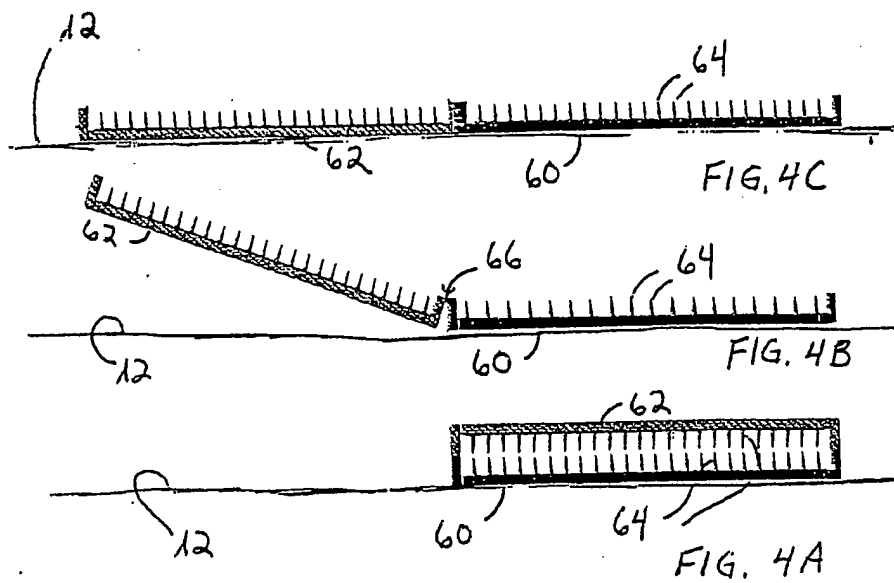


FIG. 5

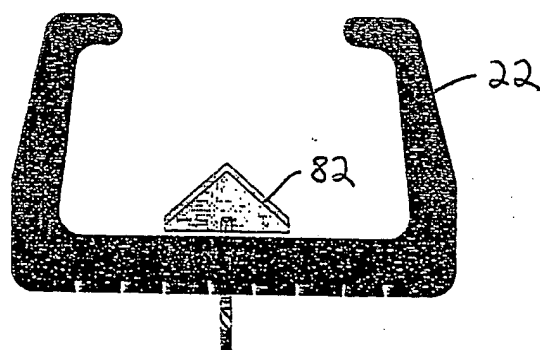
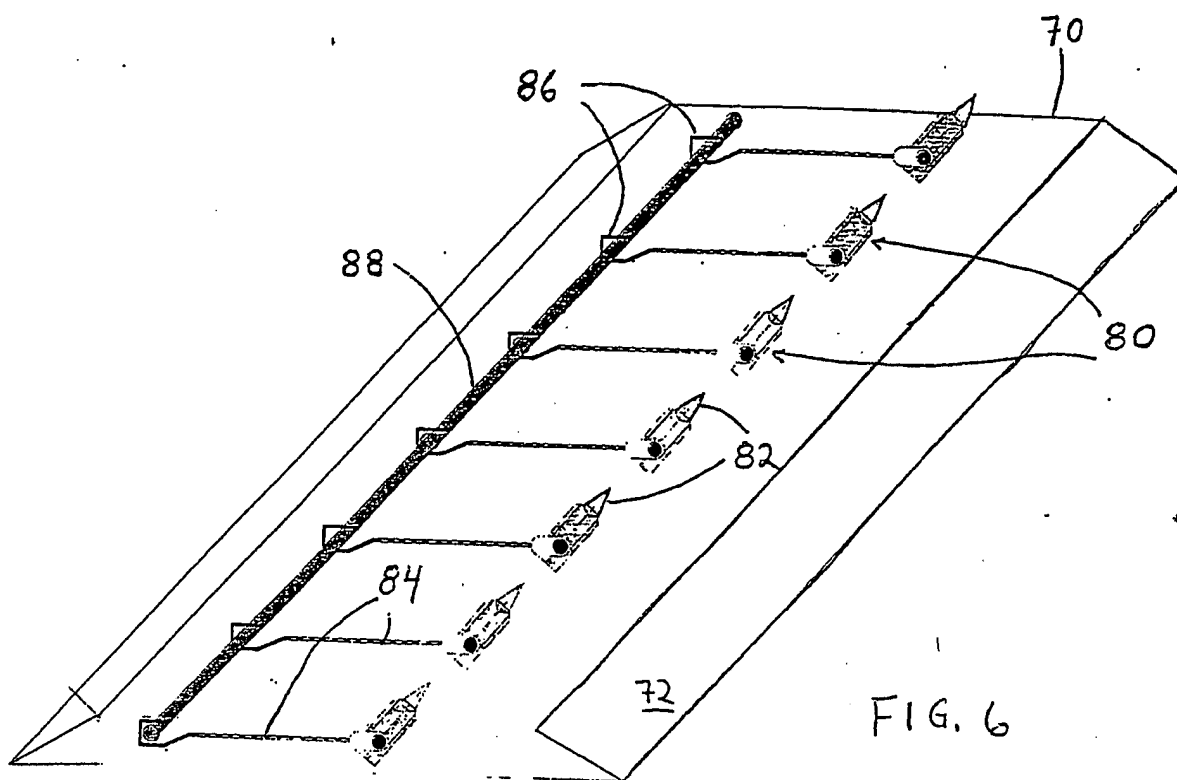


FIG. 7

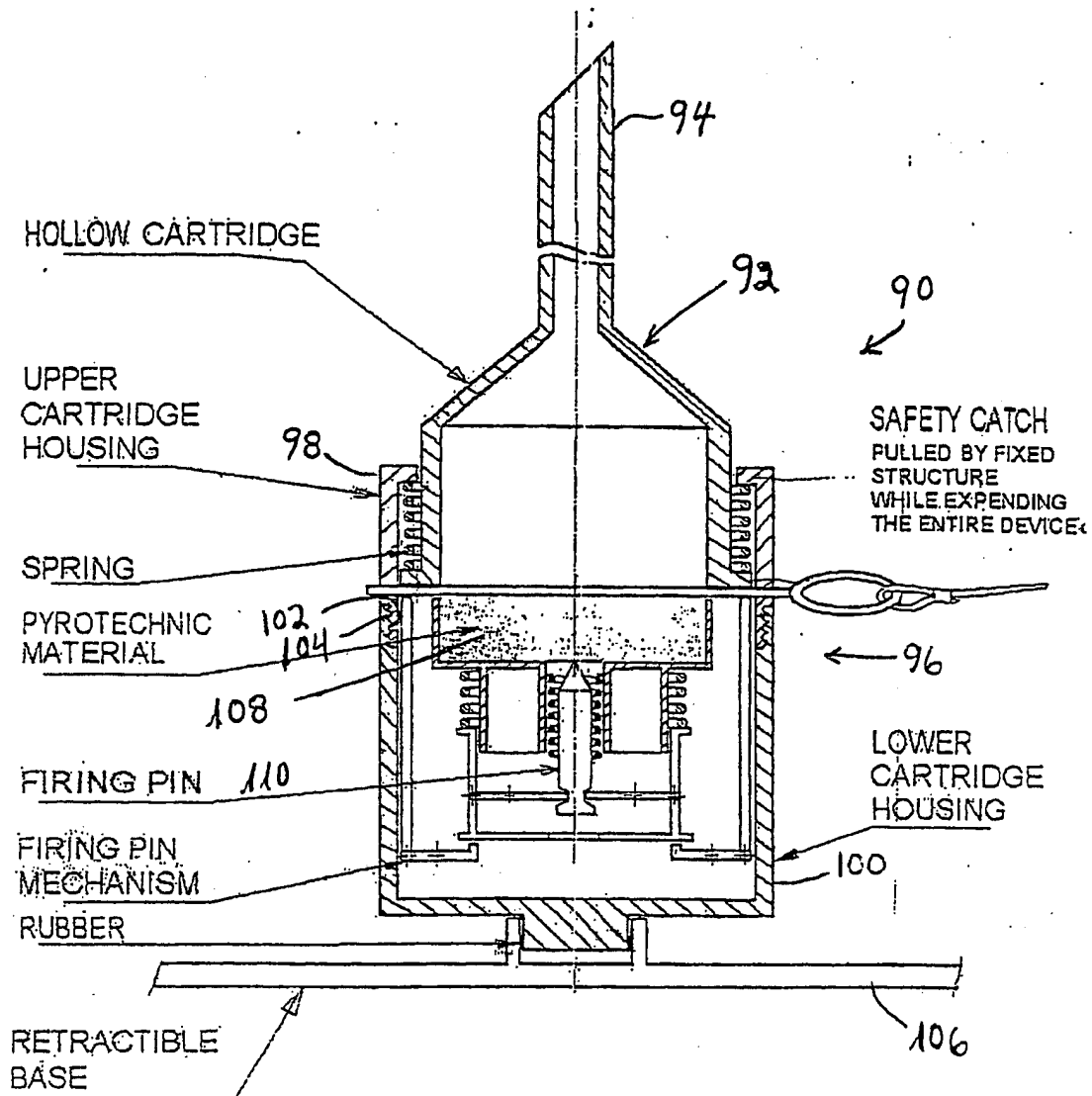


FIG. 8